Notes on Insects Infesting Pine Cones in Mississippi [1]

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Two species of the genus *Dioryctria* Zeller (Lepidoptera: Phycitidae) feed on the first- and second-year cones of the genus *Pinus* in Mississippi and are considered major pests of these reproductive structures. The larvae of *D. amatella* (Hulst.) infest the cones of longleaf pine (*P. palustris* Mill.), loblolly pine (*P. taeda* L.) and slash pine (*P. elliotii*) var. *elliotii* Little and Dorman. The larvae of *D. disclusa* Heinrich infest the cones of longleaf pine, loblolly and shortleaf pine (*P. echinata* Mill.).

The genus *Dioryctria*, according to Heinrich (1956), is represented by 4 species in the southeastern United States and only one of these species, *D. amatella*, is listed for Mississippi. This species is considered by Craighead (1949) as the most common insect pest of first- and second-year cones of "yellow pines" in the Gulf States. Pistilate flowers, cones and seeds of longleaf pines as well as cones and seeds of slash pines have been observed by Wakely (1931) to be destroyed by this insect. In Arkansas *D. amatella*, *D. clarioralis* (Walker) and *D. disclusa* are considered primary pests of loblolly and shortleaf cones (Yearian and Warren, 1964 and Yearian, 1968); in Georgia the first 2 named species and *D. zimmermani* (Grote) are considered the primary pests of shortleaf cones (Coulson and Franklin, 1968). All 4 species of *Dioryctria* listed above infest loblolly cones in Virginia and are responsible for approximately 25% cone mortality (Morris and Schroeder, 1966–67). *D. amatella* is listed as one of approximately 26 species of insects represented by 7 orders affecting seed production of slash and longleaf pines in Florida (Ebel, 1963). Merkel (1962) determined the number of larval instars of *D. abietella* (D. and S.). The parasitic insect species associated with *D. amatella* and *D. clarioralis* in Arkansas have been listed by Yearian and Warren (1964). Five insects are known to parasitize *D. amatella* in North Carolina (Neunzig *et al.*, 1964a).

Oscinella conicola (Greene) (Diptera: Chloropidae) is also considered a primary pest of loblolly and shortleaf pine cones in Arkansas (Yearian and Warren, 1964).

One of the primary insect seed destroyers of longleaf pine is *Laspeyresia ingens* Heinrich (Lepidoptera: Olethreutidae). A detailed life history study of this insect has been reported by Coyne (1968). Wahlenberg (1960) reported loblolly seed losses of 9 to 42% from cones infested with

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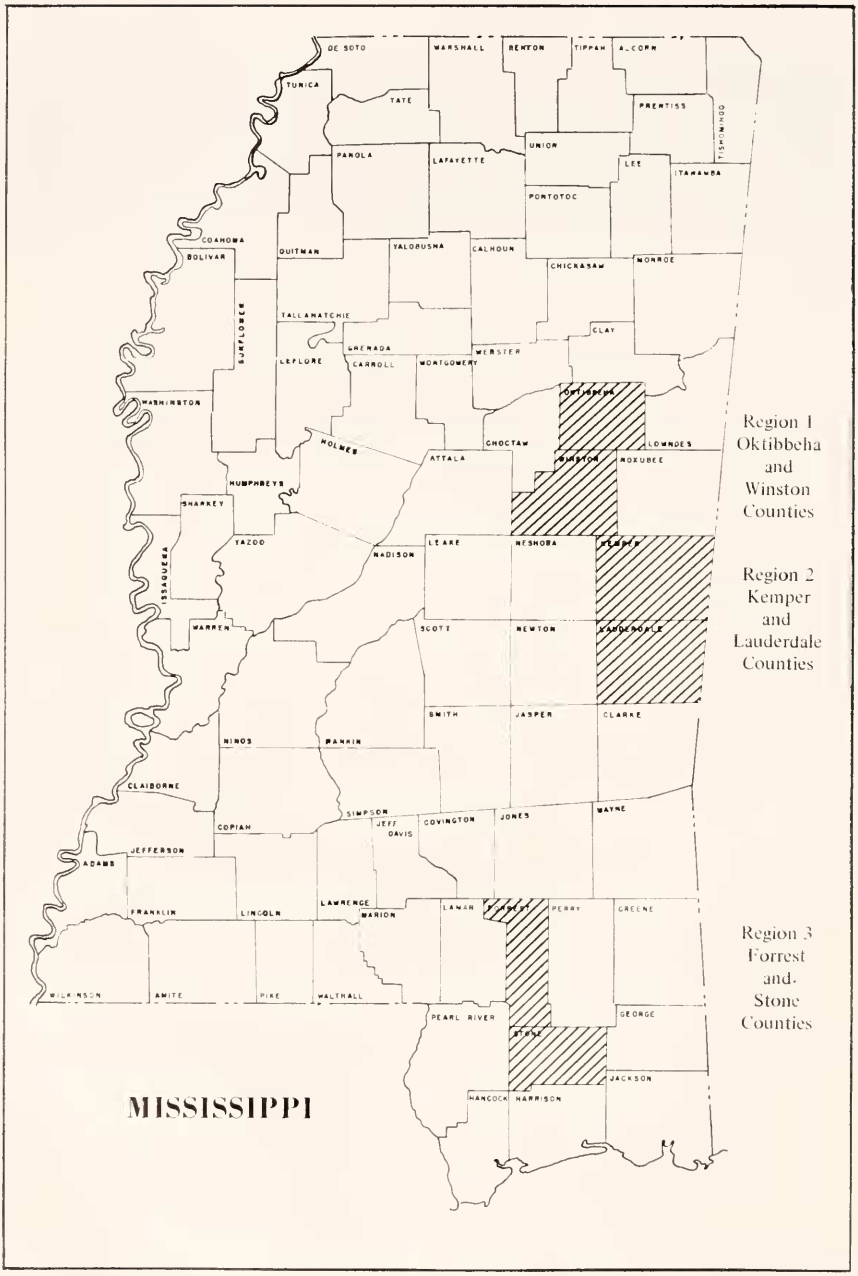

FIG. 1. Map of Mississippi showing the 6 counties where pine cones were collected for this study.

L. toreuta Grote and *D. amatella.* Merkel (1963) found that the slash pine seedworm, *L. anaranjada* Miller, occurs in the United States throughout the natural range of slash pine. In a life history study of *L. anaranjada* Merkel (1967) estimated that seed losses caused by this insect on open grown slash pines in northeast Florida vary from 2 to 10% annually.

Representatives of 3 genera, *Hyperdiplosis, Lestodiplosis* and *Mycodiplosis* of the family Cecidomyiidae are considered to be secondary pests of shortleaf pine cones in Georgia, for they caused only moderate damage directly to seed (Coulson and Franklin, 1968).

Pomphopea polita (Say) (Coleoptera: Meloidae) were observed to consume pollen catkins of shortleaf pine in Mississippi (Allen and Coyne, 1956).

Eucosma sp. near or *cocana* (Lepidoptera: Olethreutidae) was found to infest 20.4% of the second-year zones of 2 shortleaf pine trees in South Carolina (Ciesla *et al.*, 1968).

Present study

This study was initiated in an effort to learn the extent of insect damage to second-year pine cones of loblolly, slash, longleaf, and shortleaf in Mississippi. Another objective was to learn the identity and seasonal occurrence of all insects affecting these cones.

Procedures: The collection of cones was confined to the commercial pine timber lands in the following 3 localities in the state: Region 1, Oktibbeha and Winston Counties; Region 2, Kemper and Lauderdale Counties; Region 3, Forest and Stone Counties (Fig. 1). The cones collected in Regions 1 and 2 were loblolly and shortleaf; those collected in Region 3 were slash and longleaf. An attempt was made to select areas in each county where logging operations would be in progress from the beginning of the cone collections in March until the termination of the collections in September. The reason for this procedural step was to insure the collection of cones from the same vegetative type cover area during the entire 7–9 month period. Cones were collected only from felled trees.

Trees were randomly selected at five locations in a logging operation area as follows: (1) A straight course (compass line) was selected for transversing the area. (2) At a distance of 2 chains length cones were sampled from one loblolly and one shortleaf tree or from one slash and one longleaf tree. (A total of 5 trees of each species was sampled on each designated date.) (3) If no specified trees were found within 50 feet of a sampling spot the collector proceeded 2 chains to the next sampling spot. Samples were taken from trees with a DBH of 10 inches or larger. Counts of the total number of cones on each tree selected were made but collections

were made of only those cones suspected of being infested. A record was kept for each tree examined. This included date, tree species, total number of cones and total number of suspected (infested) cones. Trees were sampled once per month during March, April, June, August and September except in Oktibbeha and Winston Counties where samples were taken more often. Cone samples were taken from trees which had been felled no longer than 2 weeks.

Results

Region 1 (Oktibbeha and Winston Counties): The insect causing the greatest damage to loblolly cones was *D. disclusa*. Moths from infested cones (collected in April and May) emerged as adult moths during May and June. The largest number of moths (64 out of a total of 84) emerged during a 2-week period extending from the third week of May to the first week of June.

No other moths of this species emerged after this time although damaged cones were collected at weekly intervals in Oktibbeha County until October. Once the larva began its feeding attack inside the cone, no further cone development occurred.

A small moth belonging to the family *Blastobasidae* emerged from loblolly cones collected on June 12. Also several small moths, *Battaristis* spp. (family, Gelechiidae) emerged from a June 15 loblolly pine cone collection. These cones were dead or dying at the time they were collected but the inner cone destruction was not as great as that caused by *D. disclusa*.

Some of the loblolly cones collected during the first part of May were infested with *Asynapta* near *keeni* Foote (Diptera: Cecidomyiidae). The damage caused by this cecidomyiid is limited to the inner surface of the cone scales and to young succulent seed. A heavy infestation with excessive resin flow in the affected areas prevents the normal opening of the cone and consequent loss of seed. Some of these emerged as adults from May 15 through 22. A wasp, *Bracon gelechiae* Ashm., (Hymenoptera: Braconidae), emerged from an infested loblolly cone on May 20. This wasp, in all probability, had been parasitizing a *D. disclusa* larva. On October 6 one moth, *D. amatella* emerged from a loblolly cone collected on July 18.

No insects emerged from shortleaf cones held in the laboratory.

The average number of loblolly and shortleaf cones destroyed chiefly by *D. disclusa* larvae in Oktibbeha County was, respectively, 23.8 and 15.8%. In Winston County the average number of loblolly and shortleaf cones destroyed by this insect was, respectively, 13.0% and 6.4%.

Region 2 (Kemper and Lauderdale Counties): A few shortleaf cones were found infested with cecidomyiid maggots, *Asynapta* sp., and *Dioryc-*

FIG. 2. Longleaf pine cone infested with *Dioryctria* sp. showing typical curled appearance.

tria spp. larvae; no adult insects emerged from these cones (April 27 and 28 collections). Several loblolly cones were infested with *D. disclusa* larvae which emerged as adult moths during late May.

Only one adult moth *Duvita* (Battaristis) *vitella* Bsk. (Lepidoptera: Gelechidae) emerged from the June 26 collected cones. Some *Dioryctria* spp. moths had probably already emerged from many of these cones which appeared to have harbored an infestation.

No insects emerged from loblolly and shortleaf cones which were collected on August 17.

The average number of loblolly and shortleaf cones damaged by *D. disclusa* larvae in Kemper County was, respectively, 3.3 and 0.1%. In Lauderdale County the average number of cones damaged by this insect was, respectively, 13.9 and 3.8%.

Region 3 (Forest and Stone Counties): No insects were found infesting the slash and longleaf cones collected on March 9.

Many of the fresh green longleaf cones collected on April 27 were infested with red cecidomyiid maggots *Asynapta* spp. Three adult cecidomyiids emerged from these infested longleaf cones on May 23. *Dioryctria* spp. larvae were found infesting some of the slash cones on arrival. A month later 7 scolytids, probably *Pityophthorus pulicarius* Zinn., emerged from these slash cones as well as several small wasps, *Platygaster* sp. No adult *Dioryctria* spp. emerged from these cones. The exact role of these wasps is not known. They may have been parasitizing the developing *Pityophthorus* larvae. Several small moths, *Battaristis* spp., emerged from the slash cones.

Several *P. pulicarius* and *Ernobius granulatus* Lec. adults emerged from slash cones (May 26 collection). Also several *Platygaster* spp. adults emerged from these slash cones.

One cecidomyiid (probably *Asynapta* sp.) emerged on July 17 and two *D. amatella* adults emerged on September 22 from the longleaf cones collected on June 26. No slash cones were collected on this date.

One *D. amatella* adult emerged from a longleaf cone on October 21 and 2 ichneumonids, *Exteristes comstockii* emerged from slash cones on September 7 (September 1 collections).

Two *D. amatella* moths emerged from slash cones on October 21 (September 7 collection).

A few individuals of *Laspeyresia ingens* emerged in the spring of 1968 from longleaf cones collected the previous September.

For the period of inspection (April until September) second-year slash and longleaf cones collected in Region 3 were infested, respectively, at the rate of 20.7 and 20.1%.

A longleaf cone collected in September (Figure 2) shows the abnormal curled distortion caused by a *Dioryctria* larval infestation.

To summarize these findings a list of insects that were found to emerge from infested cones are listed below:

Loblolly pine:

Primary insects—*Dioryctria disclusa, D. amatella* and *Asynapta* near *keeni.*

Secondary insects—*Battaristis* spp., *Duvita vitella.*

Parasites—*Bracon gelechiae.*

Shortleaf pine:

Primary insects—*D. disclusa, Asynapta* sp.

Secondary insects—none recorded.

Parasites—none recorded.

Longleaf pine:

Primary insects—*D. amatella* and *Asynapta* sp., *Laspeyresia ingens.*

Secondary insects—none recorded.

Parasites—none recorded.

Slash pine:

Primary insects—*D. amatella.*

Secondary insects—*Pityophthorus pulicarius, Ernobius granulatus* and *Battaristis* spp.

Parasites—*Exeristes comstockii* and *Platygaster* sp.

Summary

Collections of infested pine cones from eight counties in Mississippi revealed that 7 common species of insects infest second year pine cones. *Dioryctria amatella* (Hulst.) was found to be a primary pest of loblolly longleaf and slash pine cones; *Asynapta* near *keeni* (Foote) was found to be a primary pest of loblolly and longleaf cones. *D. disclusa* Heinrich and *A.* near *keeni* have been found to be primary pests of loblolly and shortleaf pine cones. *Laspeyresia ingens* Hein, has been found to be a primary seed destroyer of longleaf pine. *Pityophthorus pulicarius* Zimm., *Ernobius granulatus* Lec. and *Duvita* (Battaristis) *vitella* Bsk. appear to be only secondary pests of pine cones.

Several species of parasites emerged from pine cones infested with the primary and secondary pests. Hymenopterans belonging to the families Ichneumonidae, Braconidae and Platygasteridae are apparently parasitizing one or more of the cone insects.

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